A TREATISE

ON

STEAM AND HYDRAULIC RIVETING MACHINES.

HYDRAULIC MACHINES,

AS MADE BY

WM. SELLERS & CO.,

1600 Hamilton Street, Philadelphia, U.S.,

MANUFACTURERS OF

MACHINISTS', FOUNDERS', SMITHS', AND BOILER-MAKERS' TOOLS,

SHAFTING AND MILL GEARING,

RAILWAY TURNING AND TRANSFER TABLES,

PIVOT BRIDGES, ETC.;

MANUFACTURERS OF THE

MOST IMPROVED FORMS OF INJECTOR BOILER-FEEDERS,

AND

SOLE MANUFACTURERS OF THE SELF-ADJUSTING INJECTOR.

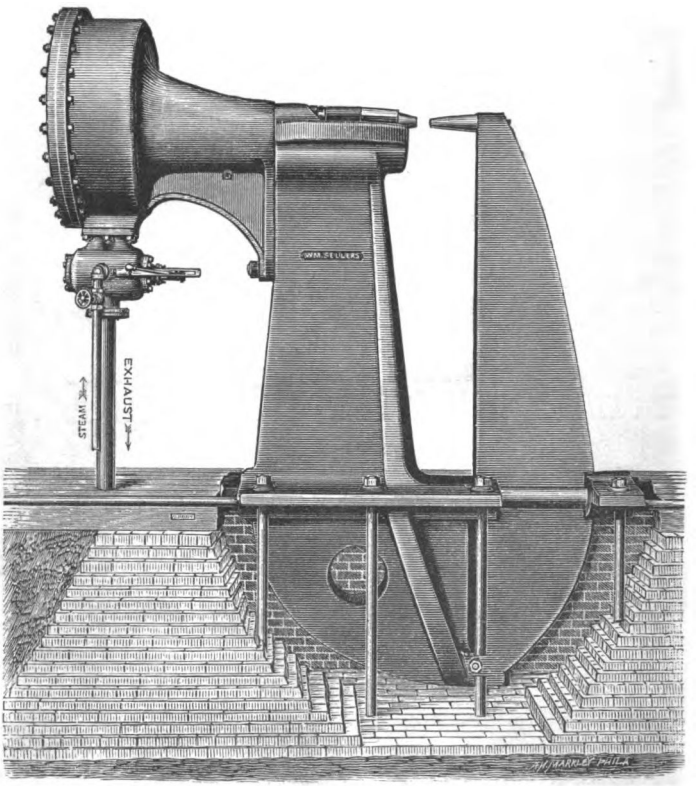
PHILADELPHIA.

1883.

PRINTED BY
J. B. LIPPINCOTT & CO.,
PHILADELPHIA.

STEAM RIVETING MACHINES.

FIG. 1.



72-INCH STATIONARY STEAM RIVETING MACHINE.

PATENT STEAM RIVETING MACHINE.

Operated by the direct action of steam, yielding a steady pressure and not driving the rivet with a blow. Cylinder separate from the main upright and so attached as to permit the substitution of hydraulic cylinder for the steam, if it is desired to change to the hydraulic system. Steam valve accurately balanced and so made as to effect the drawing back of the riveting die by the charge of steam which has been used to do the riveting. Riveting stake of best forged iron securely fitted to the main upright, and of such shape as will permit the driving of rivets in corners of square fire-boxes; the cylinder being far enough from the riveting stake to permit the driving of the rivets which fasten the waist of locomotive boilers to the fire-box. Riveting die so placed as to permit the ready insertion of the hot rivet without having to swing the boiler around for that purpose. Tension of steam required to drive ¾-inch rivets 60 pounds per square inch.

We make two sizes of these machines.

72-inch steam riveting machine will take in cylinder 27 inches diameter, driving the rivets 72 inches from the end.

60-inch steam riveter will take in sheets 60 inches wide from the rivet seam to the end of cylinders 25 inches in diameter.

To either of these machines we attach, when ordered, a supplementary riveting stake, which will permit smaller flues to be riveted without the removal of the main stake.

RIVETING MACHINES.

SINCE our first publications on the subject of power riveting, issued during the year 1874, we have made very important improvements in both the steam and hydraulic systems as carried out by us.

Tweddell's riveting machine.

As manufacturers in the United States of Mr. Ralph H. Tweddell's various Hydraulic Machines for riveting, so extensively used in England, we have largely increased the applications of his invention as well as improved the machines.

Improvements in steam riveting machines.

The improvements in our steam riveting machines have been in the direction of greater strength and

increased durability, and the application of the best features of the hydraulic system to the steam system. That is to say, we now make the steam riveters do their work by pressure, and not by impact or blow. Where the boiler pressure can be varied to suit the size of the rivets being driven, and can be maintained at a uniform pressure during the entire work, the steam riveter will be in all respects as effective as the hydraulic in stationary machines.

Boiler pressure must be uniform.

Attractive features of hydraulic machines.

The attractive feature of the hydraulic system is, that the pressure to be applied in each case is gauged at the accumulator by an adjustment of the weights, which determine the pressure per square inch on the ram of the machine. If the water be admitted to the machine from the accumulator slowly, the pressure on the ram will be that in the accumulator as determined by the weights, and if the valve is opened quickly, so as to admit a very free flow of water and a consequent rapid fall of the accumulator, there may be an increase of the pressure over that due to the weight from the impetus of the falling load on the accumulator, but not amounting to any injurious increase.

Gives uniform pressure per square inch.

Hydraulic machines lighter.

The very much higher pressure per square inch at which hydraulic machines are run, as compared to either steam or pneumatic machines, makes the cylinder smaller, and consequently the machines are less cumbersome with equal power, a matter of very great importance with portable riveting machines, and of some moment in many kinds of stationary riveting machines.

Can be driven by belt.

The hydraulic riveting machine can be used wherever power by belt is obtainable, and the pumps and accumulator may be placed at any point most convenient for the application of the power, their distance

from the riveting machine involving no serious loss in efficiency.

Steam riveters as improved.

Our very extended experience with the hydraulic riveting machine system in its various forms has led us to make alterations in the steam system of riveting to bring it to the same standard of excellence. So long as it was believed that blows were needed to do good riveting by power, the improvements in the machines were in the direction of making them stronger and better able to withstand the severe shocks which sooner or later break down all such structures. Hydraulic riveting demonstrated not only that the work could be as well done without a blow, but that it could be *better done without a blow*, and that the riveted material was stronger when so secured than when subjected to the more severe treatment under impact.

Riveting better done by pressure than by blows.

Controlling the motion of steam riveters.

Many experiments with steam riveting machines led to the adoption of a system of very small steam-pipe connections from the boiler to the riveter, coupled with an increase in the diameter of the riveting cylinder and the use of a very large valve on the machine to permit a free flow of steam in exhausting and effecting the draw-back with the charge used in driving the rivet. This improvement has brought our steam riveting plant up to the best condition of hydraulic riveting, so far as stationary machines are concerned, with the one single exception that the regularity of the steam pressure is still left to the discretion of the persons employed in doing the work. When a separate boiler is employed to run the riveter no great trouble is found in a close regulation of the steam, and the steam riveting system is very satisfactory.

Boiler pressure.

Mr. Hudson's experiments.

It was in reference to the use of one of these machines that Mr. W. S. Hudson, who was for so many

years the Superintendent of the Rogers Locomotive Works, at Paterson, N. J., said, a short time before his death, that he had for a long period of time kept records of the number of rivets driven by the hand-driving gang, and also by the gang at the steam riveting machine, in both cases making no allowances of any kind for delays. The rivets driven per month by each was, for the hand-driven rivets, at the rate of 12 rivets per hour, and for the steam-driven rivets, 120 per hour. In the case of the hand-driven rivets the boiler remains stationary and the men move about it, while the steam-driven rivets require the whole boiler to be hoisted and moved about at the riveting machine to bring each hole to the position required for the dies. Notwithstanding the trouble involved in handling and moving the boiler, it is possible to do ten times as much work, and with less skilled labor, by the employment of the riveting machine.

Extra work done by power.

During the year 1872 the editor of the *Railroad Gazette*, published in New York, caused some experiments to be tried, with the view of showing the difference, if any, existing between hand and power driven rivets. His experiments were conducted at Paterson, N. J., the power riveting being done on one of our 56-inch Direct Acting Steam Riveting Machines. Subsequently, on August 3, 1872, an article on this subject came out in the *Gazette*, from which we extract the following:

Mr. Forney's experiments with hand and machine driven rivets.

"DIRECT ACTING STEAM RIVETING MACHINES.

"In presenting a full-page illustration of the steam riveting machine designed and built by Messrs. William Sellers & Co., of Philadelphia, we take occasion to make a few remarks on the principles in-

60-inch machine.

volved and the practical use of such machines. What is manifestly required in perfect riveting is, that the metal of the rivet while hot and plastic shall be made to flow into all the irregularities of the rivet holes in the boiler sheets, that the surplus metal be formed into heads as large as need be, and that the pressure used to produce these results should not be in excess of what the metal forming the boiler shall be capable of resisting.

Flow of solids.

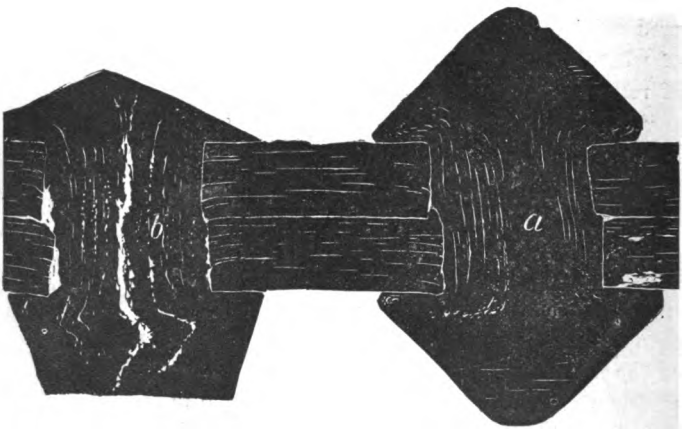
"It is well known that metals, when either cold or hot, if subjected to sufficient pressure, will obey almost exactly the same laws as fluids under similar conditions, and will flow into and fill all the crevices of the chamber or cavity in which they are contained. If, therefore, a hot rivet is inserted into the holes made in a boiler to receive it, and is then subjected to a sufficient pressure, it will fill every irregularity of the holes, and thus fulfill one of the conditions of perfect riveting. This result it is impossible to accomplish with perfection or certainty by ordinary hand riveting, in doing which the intermittent blows of an ordinary hammer are used to force the metal into the holes. With a direct-acting steam riveting machine, however, an absolutely certain and continuous pressure can be imparted to each rivet, so as to force the hot metal of the rivet into all the irregularities of the holes in the same way as a hydraulic ram will cause water to fill any cavity, however irregular. In order to test and also illustrate the relative advantages of machine and hand riveting, we have had two plates riveted together, the holes of which were purposely made so as not to match perfectly. These plates were then planed through the centre of the rivets, so as to expose a section of both the plates

Continuous pressure

Test.

and rivets. From this an impression was taken with printer's ink on paper and then transferred to a wooden block, from which our engraving was made. *a* was put in by one of Messrs. Wm. Sellers & Co.'s

FIG. 2.



machines, and *b* by hand. It will be observed that the machine rivet fills the hole completely, while the hand rivet is very imperfect. The experiment was tried several times, with similar results each time.

"The hand rivets, it will be observed, fill up the holes very well immediately under the head formed by the hammer; but sufficient pressure could not be given to the metal—or at least it could not be transferred far enough—to affect the metal at some distance from the head. So great is this difficulty that in hand riveting much shorter rivets must be used, because it is impossible to work effectively so large a mass of metal with hammers as with a machine.

Shorter rivets by hand.

The heads of the machine rivets are, therefore, larger and stronger, and will hold the plates together more firmly, than the smaller hand-riveted heads.

"Direct-acting steam riveting machines give a uniform force, if the steam pressure used be uniform, and they give such pressure as is needed, regardless in a measure of the amount of metal forming the rivet. These machines have been made on two general principles. In the English machines, a comparatively light piston of large diameter acting upon a not very large or heavy riveting ram is made to do its work by the pressure of steam alone.* In the machine illustrated, a very heavy piston and riveting ram are made to do the work by the combined effect of steam pressure and momentum. The ram and piston are of wrought iron in one solid forging, and weigh, when finished, over one ton. With the increased weight of the riveting ram a less diameter of steam cylinder is needed. Thus, it is said that one of these machines with a steam cylinder 31 inches in diameter working alongside of an English machine with a steam cylinder 36 inches in diameter does the same kind of work from the same steam boiler, and yet requires a shorter stroke, thus using less steam to accomplish the same result. In practice, it has been found that for locomotive boilers using $\frac{5}{8}$-inch rivets about 60 pounds pressure per square inch does the best work.

Weight of ram.

Pressure of steam.

"The machine illustrated is so arranged as to enable all the rivets about the ordinary locomotive boiler to

* The English machine does not do its work without a blow. Its larger cylinder, though the ram is lighter, makes its work equally severe. In our recent machines we preclude the possibility of a blow being struck by contracting the size of the steam pipe, as has been explained on page 7.—W. S. & Co.

Drive all the rivets of locomotive boilers.

be driven with ease; that is, it will rivet the corner seams of the fire box and drive the rows of rivets where the waist joins the outer shell of the fire box.

Method of using.

In the practical working of this machine it may be well to mention that the rivets are inserted from the outside of the boiler, not, as in hand riveting, from the inside. The boiler, suspended in slings attached to a crane, is drawn up to the riveting hammer, and the first blow struck carries the boiler, pushed by the rivet head, up to the post, and thus tends to close up the sheets as the head is being formed on the inside of the boiler. The second blow is then delivered with the boiler pressed up to the post or stake, and the steam pressure retained until the rivet has had time to cool.

Two blows to each rivet.

Thus two blows* are given to each rivet; and in this manner, allowing time for each rivet to cool under pressure, five rivets per minute can be driven.

Valve.

The arrangement of valve is such as to enable the charge of steam used in riveting to be utilized in its expansion to draw back the ram."

Number of men required.

To drive rivets by hand, two strikers and one helper are needed in the gang, besides the boy who heats and passes the rivets; to drive each $\frac{7}{8}$-inch rivet, an average of 250 blows of the hammer is needed, and the work is but imperfectly done. With steam riveting machine, two men handle the boiler, and one man works the machine; thus, with the same number of men as is required in riveting by hand, five rivets are driven each minute. The superior quality of the work done by

* More recent practice has shown that blows are not required: the riveting is well done by pressure, the dies being held shut until the rivet cools. The effect of the blow is rather to stretch the seam, unless in case of too low steam being used to drive a large rivet.—W. S. & Co.

the machine would alone make its use advantageous; but to this is added greatly increased amount of work done. On page 8 we give Mr. W. S. Hudson's experience with hand and power riveting. He makes the difference in favor of the riveting machine over hand riveting of at least ten to one. In setting up these machines, it is essential that they rest on good substantial foundations. We furnish with the riveter, when desired, the necessary over-head rigging of a crane, consisting of sheaves mounted in a carriage, with machinery for drawing the carriage back and forth on rails placed on beams over-head; and for hoisting purposes, we furnish a patent safety-crab, which, bolted to the foundation back of the machine, is operated either by hand or power, and is entirely under the control of the man who handles the valve of the riveter. The position and condition of the over-head rigging depend entirely on the character of the work done. When cylindrical work only is riveted, the ways upon which the over-head carriage rests may be in line with the axis of the riveting machine. If much straight-plate work is riveted, the ways should be placed cross-ways, or at right angles to the axis of machine, and a lateral motion should be given to the ways to adjust them in proper position in reference to centre of gravity of work being riveted and the position of the riveting stake. The riveting machine, as ordinarily constructed by us, is intended for locomotive work especially; but can as well do all the work on plain cylinder boilers, or on marine boilers. We also adapt, when required, a supplementary riveting stake of steel, upon which flues 10 inches diameter, and in length of 3 feet rings, may be riveted.

Foundations.

Crane attachment.

Safety-crab.

Will do all kinds of boiler riveting.

STATIONARY HYDRAULIC RIVETER.

Operated by the direct action of water from an accumulator that yields a pressure per square inch adapted to the size of the rivet being driven; presses the rivet without a blow. Cylinder separate from the main upright, operating a sliding head, which carries the riveting die; this head so arranged as to permit a very ready adjustment of the length of the stroke, saving time and economizing the water used. The sliding head arranged to permit the ready driving of the hot rivet into the holes ready for the riveter without having to swing the boiler around for this purpose. Quick draw-back to the riveting die, and all the packings so made as to be of ready access for repairs. Valve of improved construction, with very few parts to get out of order. Riveting stake of best forged iron, and so made as to permit the driving of the corner rivets in square fire-boxes, and the hydraulic cylinder is so placed as to allow the rivets to be driven in the waist of locomotive boilers close to the fire-box.

We make two sizes of these riveting machines, corresponding with the same tools as made to be operated by steam direct, viz.:

72-inch stationary hydraulic riveter has an over-reach of 72 inches, and will rivet cylinders which are 27 inches in diameter with 72 inches over-reach.

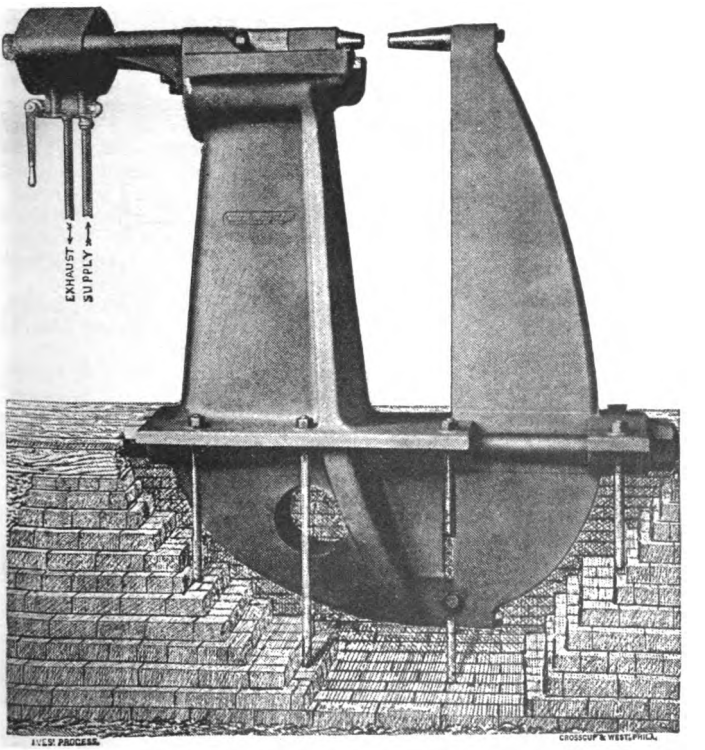
60-inch stationary hydraulic riveter has an over-reach of 60 inches, and will rivet with this over-reach cylinders 25 inches in diameter.

To both these sizes of machine supplementary stakes can be attached, which will permit the riveting of smaller flues without the removal of the main riveting stake.

Cam driven riveting machine.

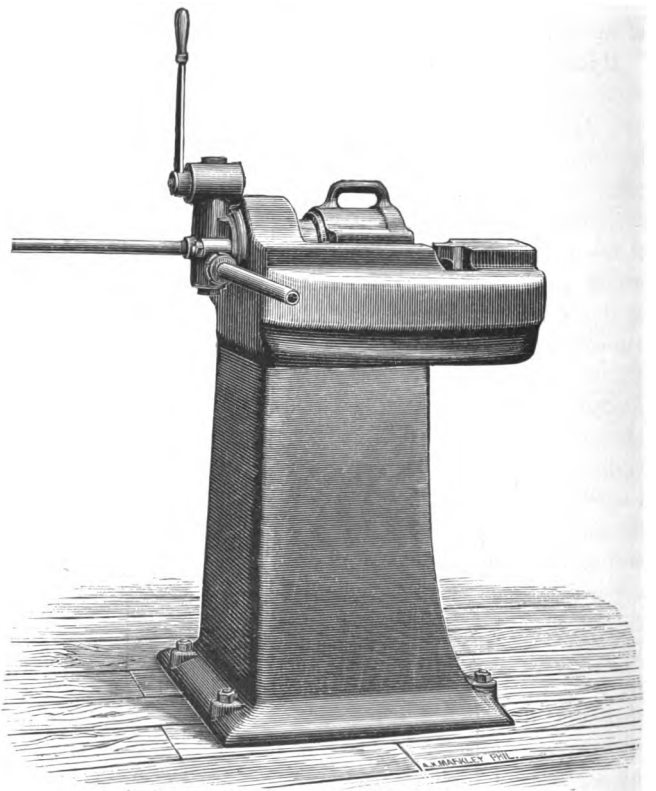
IN the earliest form of riveting machine, the riveting die was actuated either by a crank or a cam, so that the traverse of the die was uniform, and determined by this driving mechanism. The rivet, whether large or small, long or short, was compressed to the same length, often in rivet holes of varying diameters. Sometimes, therefore, the rivet did not fill the hole; sometimes the plates to be riveted were strained. The work was performed by gradual compression, in itself desirable, but the uniform traverse, operating upon irregular quantities in the rivet, and even forcing the metal into holes of varying capacity, failed to produce regular work.

FIG. 8.



STATIONARY HYDRAULIC RIVETER.

FIG. 4.



HYDRAULIC RIVETER FOR HALF-INCH RIVETS.

Steam riveting machine.

The direct action steam riveting machine produces regular work with irregular quantities in the rivet or varying size of holes; but when on such machines the work is done by a blow, the shock is, in time, destructive to the machine, and sometimes is injurious to the work.

Hydraulic riveting without accumulator.

Hydraulic riveting was first accomplished by a machine on which hydraulic pressure was employed to act directly upon a compressing piston, which carried the riveting die; but in all these hydraulic machines, a pump was employed to produce the pressure in the compressing cylinder, which cylinder was in communication with the pump chamber through a valve which was opened by the fluid whenever the pressure in the pump chamber exceeded that in the cylinder; consequently the compressing piston, which carried the die, was moved only when the pump moved to force the fluid through the valve, and rested when the pump was taking water for its next stroke. Hence the die might be stationary, while a rivet was but partially headed. Moreover, the compressing piston and die did not move at the will of the operator, but with the motion of the pump, whether it was worked by hand or power. If by hand, the workman had no means of controlling the pressure but by his judgment or strength; if by power, a valve to release the pressure was provided, which could be opened by the operator whenever, in his judgment, a sufficient pressure had been exerted, but no means of determining this with any degree of accuracy was provided in either case, so that, although the pressure was gradual, and the traverse limited only by the performance of the work, the want of means to determine the latter produced irregular results.

Want of means to control pressure.

The hydraulic riveting system combines all of the advantages and avoids all the difficulties which have characterized previous machine systems,—that is to say, the machine compresses without a blow, and with a uniform pressure at will; each rivet is driven with a single progressive movement, controlled at will. The pressure upon the rivet after it is driven is maintained, or the die is retracted at will.

Nature of the Tweddell riveter.

This machine consists of a riveting die and a holder, one or the other attached to and moved by a piston in a cylinder, which is called the compressing cylinder; this cylinder communicating with an accumulator through a valve, not self-acting, but moved by the operator, so that when the valve is opened the piston to which the die or the die holder is attached invariably moves until the rivet is headed, with a force which is positively defined by the pressure on the accumulator. Hence the work is performed without a blow; the pressure is uniform whether the rivets are long or short; it can be modified by the weights applied to the accumulator; it is continuous for each rivet, and may be maintained as long as desired, or the riveting die can be retracted as soon as the rivet is finished, whether the pump is taking water, delivering it, or at rest.

Accumulator.

The accumulator above alluded to is an essential part of the system, it is of variable capacity, in it water is kept under pressure, being forced in by means of a pump, or otherwise. The chamber of the accumulator is closed at one end, and to the other end is fitted a stuffing box, through which plays a weighted piston-rod or plunger. This plunger rises or falls as the quantity of water in the chamber increases or diminishes. By varying the load upon the plunger the

pressure upon the water in the accumulator cylinder is adjusted. The water or other fluid under pressure in the accumulator, and there stored up ready for use, is conveyed through suitable pipes and admitted by the operating valve to the compressing cylinder of the riveting machine, so that when the valve is opened the water flows into the compressing cylinder, closing the riveting dies upon the rivet, and finishing the work with just such force or pressure as the accumulator has been gauged to produce.

Pump and accumulator.

The plant required for hydraulic riveting consist therefore of an accumulator that can be loaded so as to give any requisite pressure per square inch; a means of keeping this accumulator full by pump or otherwise; and the riveting machine proper, which may be either stationary or movable within certain limits.

STATIONARY HYDRAULIC RIVETER.

FOR ½-INCH RIVETS.

Arranged to drive ½-inch rivets in the cupped heads of small boiler or air cylinders. Will drive rivets in the head of cylinders 10 inches in diameter. Cylinder moves, and can be readily taken out to re-set the packings. Valve of improved construction, not liable to get out of order, and ready of access to its parts.

This very handy little machine was originally made to drive the rivets in the heads of the cylinders used in connection with the Westinghouse air-brake, and it is one of the tools best adapted to rivet in the heads of log boilers, such as are used with ranges.

WITH our double pump accumulator it is quite possible to run one of these machines in connection with one of the larger riveters, provided the work done in size of rivet is constant and the machines are adapted to that pressure.

See Fig. 4.

ADJUSTABLE ACCUMULATOR AND PUMP.

Arranged with weights suspended below the main casting, so made as to be readily released from it to adjust the pressure to the work being done. These weights, four in number, gauging the pressure in equal steps from the lightest to one hundred per cent. increase over the lowest pressure. Main upright for the pump arranged with an improved sponge filter to clear the water before it enters the pump of all gritty matter; the filter has ready access for washing out by means of man-holes in the side of the upright. Improved relief valve, stopping the flow of water to the accumulator when it is full, but permitting the pumps to run full, ready for action but freed from pressure. Pumps double-acting, and fitted with improved attachments, to permit their quick opening to adjust or renew packings.

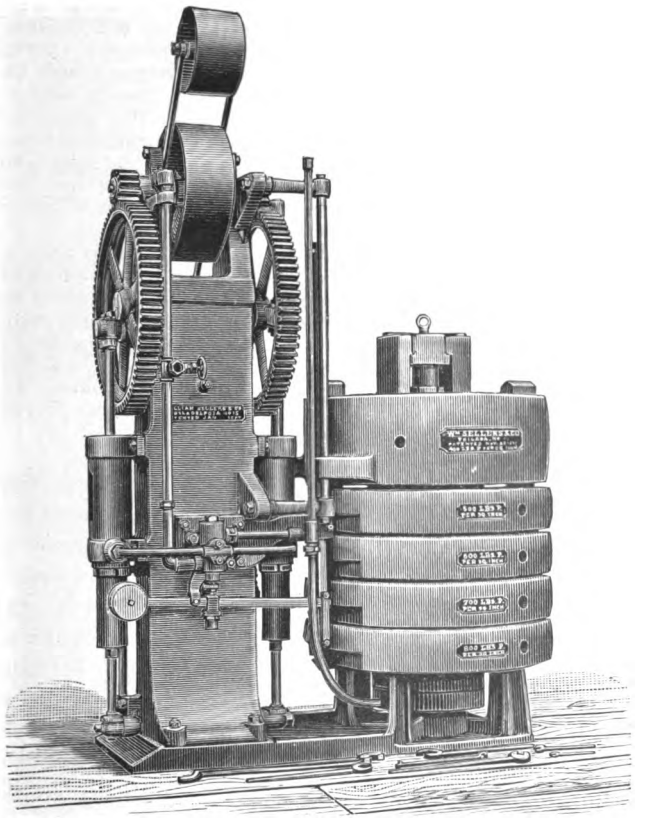
Our single pump accumulator has a pulley 16 inches diameter on the top of the upright, which pulley should make 250 revolutions per minute. Accumulator with two pumps has a pulley on the top of the upright 20 inches diameter 7 inches face, which pulley should make 250 revolutions per minute. In both these machines the belt is brought into action by means of a tightner attached to the machine, and the accumulator is best placed immediately under the main driving shaft, so that the belt will hang clear when it is not driving the pumps.

THE pump or pumps, which are double-acting, operated by crank motion, are of improved construction, and take water from a reservoir in the upright. The return water in entering the reservoir passes through a mass of sponge to filter it. An important feature in the arrangement of pump and accumulator is the adaptation of our improved relief valve to the system. This valve is so constructed and controlled by the motion of the accumulator as to relieve the pump from work without stopping its motion when the accumulator is full, and to start it to pumping into the accumulator as soon as the accumulator weight has descended a short distance. When this valve is open, the water under pressure in the accumulator is shut off from the pump, and the pump relieved from pressure draws

Water filtered.

Relief valve.

FIG. 5.

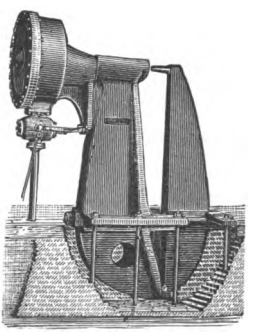


ADJUSTABLE ACCUMULATOR AND PUMP.

water from the reservoir and forces it back into the same reservoir, maintaining its action without strain, but ready to resume its work when required. When the relief valve is closed, the pump forces water directly into the accumulator. When the accumulator is full, and no water is being taken from it, the pump must either stop or discharge its water elsewhere. To stop the motion of the pump when the accumulator is full, involves its being again started promptly when required, which is not very readily done, and risks the loss of water and entrance of air into the chamber while standing. To maintain the action of the pump and discharge under a safety valve involves the expenditure of power when no useful work is being done. Our arrangement maintains the motion of the pump ready for immediate action, and yet relieves it from strain when not required to do any work.

Stopping pump.

Discharge under a safety valve.



PORTABLE HYDRAULIC RIVETING MACHINE.

PORTABLE HYDRAULIC RIVETING MACHINE.

We make portable hydraulic riveting machines on the Tweddell system for various parts of bridge construction, and have introduced many improvements in the construction of the machines and in the attachments belonging to the machine, such as the cranes and conveniences for working the machines or handling the work.

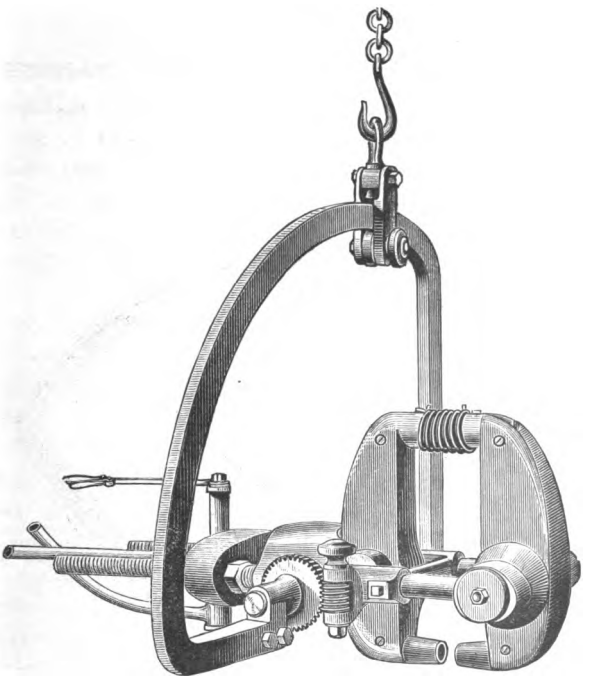
Position in shop.

For bridge work construction in the shop,—the pump and accumulator are placed in any convenient position, and the water under pressure is carried through jointed or flexible pipes to a portable riveting machine suspended from an over-head carriage. In using this portable riveting machine the work resting on trussels remains stationary, the riveter is moved along it from rivet to rivet to be driven, performing the work with surprising rapidity and accuracy, and without noise or jar. The whole machine or combination is also arranged for use in the field, by providing a car with boiler, engine, pumps, and accumulator on it, the portable riveter being suspended from a crane or derrick attached to the car. This permits the use of the machine in driving the rivets in bridge erection or in ship-building.

Riveter for lattice girders.

We also make a direct acting portable riveting machine for driving the rivets in plate girders or lattice work. The openings in the throat of machine being wide enough to span the top and bottom chord and the over-reach sufficient to span the girder.

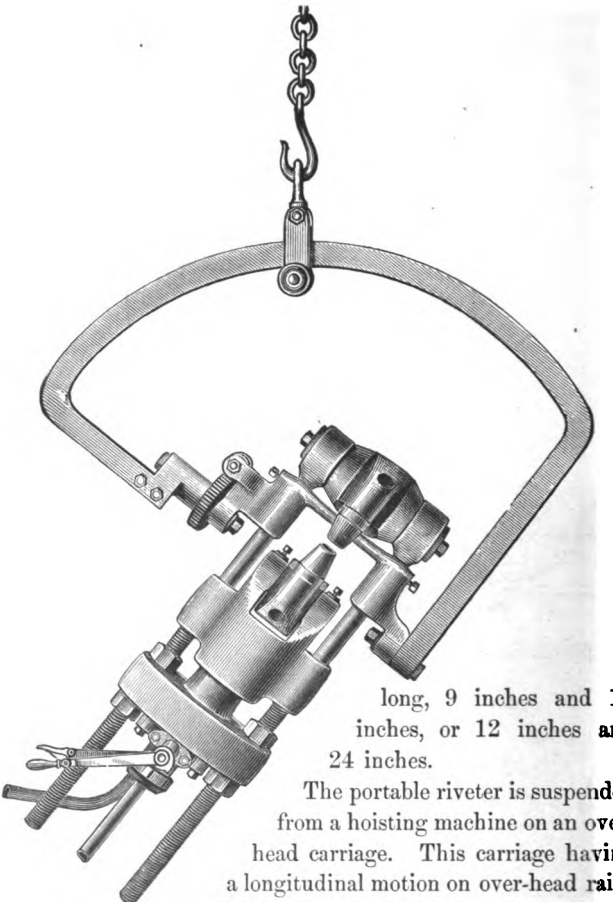
FIG. 6.



THE PORTABLE RIVETING MACHINE.

WE give in Figs. 6, 7, and 8, this useful machine in three positfons; showing how it may be adjusted to act readily on seams oblique, horizontal, or vertical. Fig. 6 shows the shape of the riveting jaws or levers. The rivet is driven by the dies in short ends of levers. We make these levers or jaws of various lengths, suited to different work. In all cases the proportion of the two ends is as two is to one. Thus, we make lever 6 inches and 12 inches

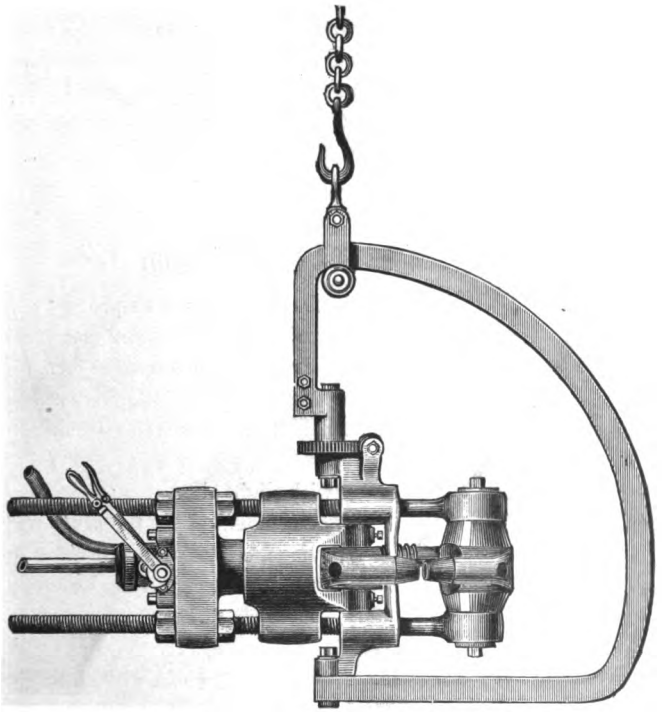
FIG. 7.



long, 9 inches and 18 inches, or 12 inches and 24 inches.

The portable riveter is suspended from a hoisting machine on an over-head carriage. This carriage having a longitudinal motion on over-head rails, of in some cases, 50 feet, and a transverse motion of 6 feet; thus permitting the use of the machine at any point within a space of 50 feet by 6 feet wide.

FIG. 8.



In this space the work rests on trussels and the riveting machine is moved along or around it.

One man raises and lowers the riveter, adjusts it to the rivets, and then closes the dies on the rivets. Boys drop the red-hot rivets into place with the head of the rivet uppermost in horizontal work. With a skillful operator, as many as 6 to 10 red-hot rivets may be put in place ahead of him, and he can, on beam work, drive from 10 to 16 rivets per minute. Speed of work.

RIVET HEATING FURNACES.

In using the hydraulic riveting machine to advantage the rivets should be heated rapidly and uniformly. To accomplish this we have arranged furnaces inclosed in sheet iron covers, with every convenience for rapid handling of the rivets by the boys who attend to this part of the work.

OVER-HEAD CARRIAGE FOR HYDRAULIC RIVETERS.

THE portable hydraulic riveter is suspended from an over-head carriage; the hoisting machinery of this carriage is one of the improved forms of Weston's hoists, working with very little friction, and capable of nice adjustment of the riveting machine to any position.

Weston's patent hoist.

The same carriage with slight alteration can be made to lift 1000 pounds, and, mounted on the same ways as carry the riveter carriage, can be used to lift and adjust the work to be riveted. To obtain the best result with these riveters, the extra hoisting machines are desirable.

1000 lbs. hoist.

We can estimate for riveting plant when informed of the kind of work it is to be used on, and the character of the building in which it is to be erected.

Estimate of Riveting plant.

The hydraulic riveting machinery is inexpensive to maintain, if a very little attention is paid to keeping it in good order. It, like all other hydraulic machinery, should be kept up; not allowed to deteriorate by careless usage. Slight leaks, if stopped by attention to the packing at once, will give no trouble; if neglected, may amount to serious wear from rust and abrasion.

HYDRAULIC MACHINES.

Hydraulic pumping engines—Hydraulic accumulators for high and low pressures—Platform hoists, operated by water—Hydraulic moulding cranes for car wheels.—Also large water cranes for foundry use, arranged with very superior valves, and designed with especial view to durability and convenience; as well as hydraulic punching, riveting, and forging machines.

HAVING been engaged for many years in the manufacture of hydraulic machines, we have accumulated a large assortment of patterns of the various useful appliances of this very convenient mode of transmitting power and of using it in machines. We are prepared to furnish all that may be required for the introduction of hydraulic motors and machine tools into warehouses or workshops.

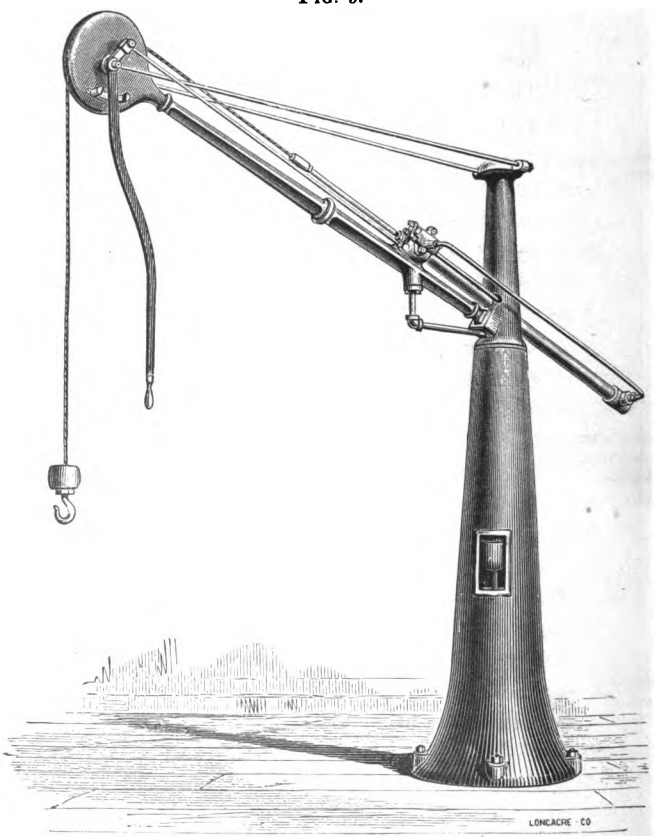
Transmitting power by water.

The very great convenience of the hydraulic system of working hoisting machines has caused its introduction into some of our largest works, and the improvements introduced recently have tended to materially decrease the first cost of the plant needed. This first cost, which may seem great when a single machine or hoist is to be operated, becomes trifling when the use of the power is extended to a wider range of machines. Thus, in any event a pumping engine and accumulator are required; but when these two machines are in place a very considerable number of machines or hoists may be operated from the same source of power with less cost for each machine, and very much less cost of conducting the power to it, than by any other known method. In this country the use of this power has been mainly confined to hoisting machines; but we have recently extended its use to all purposes of shearing, punching, and riveting machines, as also to forging presses and like purposes. We give on page 30 a cut of a very convenient crane for moulding pur-

Pump and accumulator.

Use in this country.

FIG. 9.



HYDRAULIC MOULDING CRANE.

Water lifts for Pa. Railroad.

poses,—one of the series of machines designed by us for the use of the Pennsylvania Railroad Company in their wheel foundry at Altoona. In this machine the weight is raised and the empty hook lowered by power, with very little loss of water, so that the usual heavy ball at hook is not required, facilitating its use. The hand lever is near to the work, thus dispensing with an assistant to move the valve.

Ladle-tilting machine.

We have also arranged convenient ladle-tilting machinery for car-wheel foundry, and automatic cranes for placing the red-hot car wheels in the annealing pits. Some of the machinery of this description made by us has been in operation for more than fifteen years, without any notable need of repair. We have also extended its use to other machines for special purposes, clearly demonstrating the advantage and economy of the mode of operation.

Use of water cranes in the Bessemer mills.

The universal employment of the hydraulic system in the operations incident to the Bessemer process has rendered many persons familiar with its use; but while the direct-acting crane commonly used in handling the ladles and ingot moulds in the Bessemer mills seems simple and convenient, it is wholly inadmissible with the greater loads and higher lifts needed in foundries. We have therefore adopted the system

Foundry cranes.

of drums and chains common to all foundry cranes, with the addition of convenient and durable water engines to impart the necessary rotary motion. They are so arranged as to materially economize the power over any plan heretofore brought to our notice, using water only in hoisting, not in lowering weights.

Breaking machines.

We have patterns for breaking machines for casting, one having a lift of forty feet, weight of drop one ton, and a smaller one of ten feet lift and one ton drop.

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